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FINANCIAL REGULATION, FINANCIAL GLOBALIZATION AND THE SYNCHRONIZATION OF ECONOMIC ACTIVITY

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ABSTRACT

We analyze the impact of financial globalization on business cycle synchronization utilizing a proprietary database on banks' international exposure for industrialized countries during 1978- 2006. Theory makes ambiguous predictions and identification has been elusive due to lack of bilateral time-varying financial linkages data. In contrast to conventional wisdom and previous empirical studies, we identify a strong negative effect of banking integration on output synchronization, conditional on global shocks and country-pair heterogeneity. Similarly, we show divergent economic activity as a result of higher integration using an exogenous de-jure measure of integration based on financial regulations that harmonized segmented EU markets.

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1 Introduction

What is the role of global financial markets in the international propagation of country-specific shocks? This question is at the center of the current academic and policy debate involving global financial stability, new financial architecture, and monetary policy coordination. The $2007 - 2008$ crisis lead to heated debates on whether it was the outcome of a common shock to industrial countries' asset markets or whether financial globalization, banking integration in particular, has been the catalyst for amplifying and transmitting a moderate shock from a corner of the U.S. capital markets to the rest of the world. Although we still lack direct evidence on these arguments, both find support in the observation that synchronization of economic activity and financial globalization go in tandem.

We argue that the fundamental problem with this view is the lack of systematic evidence for the benchmark: the co-movement of output and financial integration during periods of financial stability — i.e., how financial globalization affects output co-movement during normal times. If two financially integrated countries show a high degree of output and equity return synchronization during tranquil times, then a high correlation after one country experiences a financial shock does not constitute contagion. Contagion would emerge only if the synchronization of economic activity between financially integrated countries is higher after the shock relative to the benchmark, conditional on the common shock and other factors that may simultaneously affect world market integration and business cycle synchronization. A key question is then whether output co-movement across markets increased as a result of financial globalization during the last decades. In this paper we show that – in contrast to the current conventional wisdom and previous empirical studies– this is not the case.

Theoretically the correlation between financial integration and business cycle synchronization is ambiguous. Both finance/banking and macroeconomic theoretical models make opposing predictions on the association between financial integration and the synchronization of economic activity, depending on whether financial shocks to the banking sector or collateral/productivity shocks to firms dominate. The commonality in both set of models is as follows. In a financially integrated world, if firms in certain countries are hit by negative (positive) shocks to their collateral or to their productivity, both domestic and foreign banks decrease (increase) lending in these countries and increase (decrease) lending in the non-affected countries, thereby causing a further divergence of output growth. In contrast, if the negative (positive) shock is to the banking sector, globally operating banks pull out funds from all countries, transmitting the domestic banking shock

internationally, making business cycles of the two countries more alike.[1]

Given these theoretical ambiguities and related empirical issues, the identification of the one-way effect of financial integration on business cycle synchronization entails various challenges. First, a positive association between cross-border financial linkages and output co-movement may reflect a spurious correlation arising from commonalities between countries. Proximate countries that have strong economic ties and are similar in other sociopolitical dimensions tend to have both more synchronized output fluctuations and stronger cross-border financial linkages. In fact, previous empirical studies show that most of the robust correlates of both output co-movement and financial integration are indeed factors related to proximity.[2]

Second, the response of integrated economies to common shocks will be similar. There has been a common trend in both financial globalization and synchronization of economic activity over the past decades. Figures 1 and 2 illustrate these patterns in our data. Yet the coevolution of financial integration and output synchronization does not necessarily imply a causal relationship, as it can be driven by other features of globalization, such as trade integration, outsourcing, increased coordination of monetary policy, etc.[3]

Third, a significant negative association between banking linkages and business cycle synchronization may be driven by the fact that capital flows to high return/high growth countries. These return and growth differentials may also affect risk sharing/taking.[4] International diversification benefits become larger when stock returns are less correlated across countries, and thus financial flows may increase among dissimilar economies.

Fourth, measurement error in the bilateral data on international capital holdings might attenuate the estimates or even lead to systematic biases. International capital holdings/flows data are far from perfect as they tend to miss indirect links via financial centers, are usually based on surveys, and are mostly available for the recent years.

[1] See Holmstrom and Tirole (1997), Morgan, Rime, and Strahan (2004), Allen and Gale (2000), Perri and Quadrini (2001), Mendoza and Quadrini (2010), and Enders, Kollman and Muller (2010) among others. In Section 2 we discuss in detail the theoretical mechanisms.

[2] Baxter and Kouparitsas (2005) show that geographic and cultural proximity variables are the most robust correlates of output synchronization. Portes and Rey (2005), Guiso, Sapienza, and Zingales (2009), Ekinci, Kalemli-Ozcan and Sørensen (2008), Giannetti and Yafeh (2008), Mian (2006), and Papaioannou (2009), among others, show that distance and cultural ties are strong correlates of international financial activities and banking in particular.

[3] See Rose (2009) and Inklaar, Jong-A-Pin, and de Haan (2008) on the business cycle synchronization effects of monetary policy and fiscal policy coordination, respectively.

[4] For the effect of financial integration on international risk sharing and volatility see Bekaert, Harvey, and Lundbad (2005, 2006, 2011), Bekaert, Harvey, Lundblad, Siegel (2007), Kose, Prasad, Rogoff, and Wei (2009), Kalemli-Ozcan, Sørensen, and Yosha (2001, 2003), Kalemli-Ozcan, Sørensen and Volosovych (2010), and Kalemli-Ozcan, Papaioannou, and Peydro (2010), among others.

Our methodology for estimating the impact of financial integration on business cycle synchronization focuses on changes over time for the country-pairs. We examine the dynamics of financial integration and business cycle synchronization within more than 150 pairs of countries over the period $1978 - 2006$. Our panel estimates assess how the evolution of business cycle synchronization is affected when bilateral financial linkages and financial sector regulation change within each country pair conditional on common shocks. To the extent that this *within* country-pair comparison fully absorbs country-pair specific differences in synchronization and integration, the estimated difference can be plausibly attributed to changes in the degree of financial integration over time. To the best of our knowledge, our paper is the first that uses this methodology, combining panel data on bilateral cross-border financial holdings with a structural index reflecting convergence in the regulation of financial intermediation across country-pairs. This strategy allows us to account for all the above mentioned identification challenges.

In the first part of our empirical analysis we use a quantity-based measure of financial integration exploiting a proprietary database from the Bank of International Settlements (BIS) that reports bilateral international bank assets and liabilities over the past three decades for a group of developed countries.[5] The extensive time dimension of the data allows us to account for fixed country-pair factors and global shocks (the first and second identification challenge). Our results show that accounting for these factors is fundamental. While between country-pairs there is a significant positive correlation between banking integration and output synchronization, our panel estimates show that (within country-pair) increases in cross-border banking activities are followed by less synchronized, more divergent, output fluctuations. This result stands in contrast to previous empirical works that lacked high quality time-series bilateral data. While in line with theory that characterize the correlation between financial integration and output synchronization in tranquil times, our findings contrast the conventional wisdom that financial globalization has lead to an increased synchronicity of economic activity.

While the supervisory BIS data reflect more than 99% of the international exposure of the local banking system, they do not capture other forms of international investment (such as FDI and portfolio investment) by non-banks. Moreover, the BIS data (as most international capital data) miss investment channeled via small off-shore financial centers. To account for these caveats (related

[5]The literature on cross-border financial integration employs either de-facto (quantity and price based) or de-jure measures (see Adam, Jappelli, Menichini, Padula, and Pagano (2002) for a general discussion). De-facto indicators are typically outcomes, such as quantity of international bank or equity holdings (Lane and Milesi-Ferretti (2007)) or return correlation (Bekaert and Harvey (1995)). De-jure measures are based on the timing of stock market liberalization (Henry (2000); Bekaert, Harvey, and Lumsdaine (2002)) or the removal of capital account restrictions (such as the widely used AREAER index of IMF).

to the fourth identification challenge), we construct a structural index of financial integration, based on the adoption timing of financial sector legislation that aims to harmonize the regulatory framework in financial intermediation across European Union (EU) financial markets. Compared to outcome-based indicators (such as international capital holdings and return correlations), employing a structural de jure measure of financial integration allows us to account for reverse causation arising from the fact that international banking may react to the synchronization of output fluctuations (the third identification challenge). Importantly, since the structural index of financial integration varies over time for each pair of countries, we can still account for country-pair heterogeneity, global shocks, and common trends.

To construct the structural index of financial integration, we exploit in a quasi-natural experimental setting the peculiar nature of adopting EU-wide legislation across EU member countries. The Financial Services Action Plan (FSAP) was a package of financial reforms launched by the EU in 1998 aiming to integrate the segmented EU financial markets and reduce the costs of cross-border financial intermediation. The FSAP included 29 major pieces of legislation (27 EU Directives and 2 EU Regulations) in banking, capital markets, corporate law, payment systems, and corporate governance. In contrast to EU Regulations that become immediately enforceable across EU member countries, EU Directives are acts that become enforceable only after each EU member country passes domestic legislation adopting the EU Directive. The legal adoption of the EU Directive (the so-called "transposition" process) is notoriously slow, since it requires modifications of existing institutional structures, the removal of previous regulations and, in many cases, the establishment of new agencies and infrastructure. The transposition of the EU Directives takes in practice several years and differs considerably across EU member states. Using information from the EU Commission on the adoption timing of each of the Directives of the FSAP across EU countries, we construct a bilateral time-varying index that reflects how similar are the legal/regulatory structures governing the functioning of financial intermediation across each country-pair in each year.

Our (reduced-form) panel estimates show that a higher degree of legislative/regulatory harmonization in financial services is associated with less synchronized output cycles. After showing that the simultaneous adoption of the EU-wide legislative acts by member countries are followed by increases in cross-border banking activities, we combine these results into a bilateral panel instrumental variables method. Our identification scheme builds on the insights of the law and finance literature showing that sound investor protection and legal quality lead to deep and efficient capital markets.[6] It is also related to a new strand in corporate finance and law and economics that

[6]See La Porta *et al.* (1997, 1998) and La Porta, Lopez-de-Silanes, and Shleifer (2008) in particular who examine

examines the effects of legal convergence on capital markets.[7] Our identification method associates changes in the legal/regulatory environment governing financial intermediation that aim to harmonize segmented financial systems with changes in cross-border banking activities among countries that adopt the same piece of legislation and, in turn, with changes in output synchronization. The panel instrumental variable (IV) analysis reveals that the exogenous component of banking integration stemming from the harmonization of the regulatory environment in financial services makes business cycles less alike.

The paper is structured as follows. In the next section we detail the theoretical predictions of finance/banking models and international macro models. We also discuss previous empirical works that due to data limitations could not account for the various econometric challenges. Section 3 describes our data. Section 4 reports the cross-sectional and the panel estimates on the effect of cross-border banking integration on business cycle synchronization. In Section 5 we report panel estimates associating business cycle synchronization with the structural index of financial integration. Section 6 presents instrumental variable estimates associating legal convergence in financial services with banking integration (in the first-stage) and output synchronization (in the second-stage). Section 7 concludes.

2 Related Literature

Theory makes opposing predictions about the effect of financial integration on international business cycle synchronization depending on the nature of the underlying shocks. In this section, we explain in detail the alternative theoretical channels modeled from the finance/banking and the international macro/finance literature and then go over previous empirical works.

2.1 Theory: Financial Integration and Lower Synchronization

Morgan, Rime, and Strahan (2004) develop a multi-economy variant of the canonical banking model of Holmstrom and Tirole (1997) and test it using cross-state banking exposure data across U.S. states. They show theoretically that if firms in certain states are hit by positive shocks that increase the value of their collateral, they receive more credit. Under financial integration, both local banks and banks from other regions will provide credit to the borrowers hit by the positive shock due to

the effect of securities legislation on capital markets' development.

[7] See, among others, Balas, La Porta, Lopez-de-Silanes, and Shleifer (2009) and Enriques and Volpin (2007).

the increased value of collateral. As a result, output will increase in the affected region relatively more as compared to output in other regions, making cycles to further diverge. If a negative collateral shock hits one region (because productivity falls), then both local and out-of-state banks move away from the affected region, delivering the same asymmetry result for regional business cycles.

Working in an international context, Bekaert, Harvey, and Lundblad (2005) argue that if a country that liberalizes its equity markets has better growth opportunities than others (because for example its production is concentrated in high global demand sectors), following a financial liberalization episode, capital will flow to that country and therefore output patterns between the two countries will diverge (see also Bekaert, Harvey, Lundblad, and Siegel (2007)). By the same token, negative shocks will lead to capital withdrawals and thus output differences among financially integrated economies will get amplified.

International real business cycle theories model a similar mechanism that also yields a negative correlation between financial integration and output synchronization in a dynamic general equilibrium framework. In the workhorse model of Backus, Kehoe, and Kydland (1992) with complete financial markets, the country hit by a positive productivity shock experiences an increase in the marginal product of capital and labor, workers substitute leisure for labor, and the country receives capital on net – a mechanism that leads to negative output correlations between the two countries. A negative shock delivers the same effect, since the country that was not hit by the negative shock has relatively better growth opportunities and thus capital will be directed there.

In a dynamic general equilibrium set-up causality can also run in the other direction. Heathcote and Perri (2004) show that a lower degree of synchronization due to changing nature of shocks increases demand for diversification and hence increases bilateral financial integration via a higher volume of asset trade. Kalemli-Ozcan, Reshef, Sørensen, and Yosha (2010) show that under full diversification of capital income, investment patterns are solely determined by relative productivity. Their model (and empirical results) suggests that capital will flow to the states with the highest productivity growth, creating even more divergent growth patterns.

A completely different mechanism linking financial integration and output synchronization based on industrial specialization was studied by Obstfeld (1994). In his model, financial integration shifts investment towards risky projects as it enables countries to specialize according to their comparative advantage; this implies that output growth among financially integrated countries

should be negatively correlated.[8]

2.2 Theory: Financial Integration and Higher Synchronization

The model of Morgan, Rime, and Strahan (2004) predicts that banking integration may lead to more, rather than less, synchronized output cycles. This will occur if the shock is not the banking sector rather than firm's productivity/collateral. If there is a negative shock to banks' capital, the induced contraction of credit supply may have negative real effects for the domestic economy.[9] If the domestic credit supply reduction is significant, under banking integration, the business cycles of the two inter-connected regions/economies will become more synchronized since banks that operate in financially inter-connected regions pull out funds from the non-affected region to continue lending in the affected region. Allen and Gale (2000) model this contagion-type mechanism through interconnected bank balance sheets; in their model shocks are transmitted through the interbank markets by banks from affected countries pulling out their international deposits and thus transmitting internationally the local shock.

Dynamic stochastic general equilibrium models may also yield a positive relation between banking integration and business cycle synchronization stemming from the feedback from interest rates to capital values. The early literature models this by introducing financial frictions into the standard model with productivity/technology shocks, where frictions stop or reverse the direction of capital flows (Calvo and Mendoza (2000)), or leveraged and constrained firms liquidate and run down asset prices when they got hit by a negative productivity shock to their capital (Devereux and Yetman (2009)). The recent literature introduces banking shocks in addition to productivity shocks (e.g. Perri and Quadrini (2010); Mendoza and Quadrini (2010); Enders, Kollmann, and Muller (2010)). In these models, different mechanisms operate where banks and/or firms have collateral constraints. When there is a negative shock to the banking sector in the domestic economy, banks cut their lending globally since their net worth goes down and they have to shrink their

[8] In line with this argument, Kalemli-Ozcan, Sørensen, and Yosha (2003) using regional-level data show that financial integration leads higher industrial specialization. Using country-level data Imbs (2004) and Kalemli-Ozcan, Sørensen, and Yosha (2001) show that higher industrial specialization leads to less synchronized cycles.

[9] This potential reduction in firm borrowing does not seem to be the case for the firms in developed countries as shown by Rice and Strahan (2010) for U.S. and Jimenez, Mian, Peydro and Saurina (2010) for Spain. In developing countries, credit supply contractions may be more binding for firms, as shown, for example, by Paravisini (2008) for Argentina; Khwaja and Mian (2008) for Pakistan, Paravisini, Rappoport, Schnabl, and Wolfenzon (2010) for Peru; and Kalemli-Ozcan, Kamil, and Villegas-Sanchez for 6 Latin American countries. The last two papers show real effects in terms of declining exports (Peru) and declining investment (6 Latin American countries) of firms. In a global financial crisis, such as the $2007-2009$ recession, even developed country firms may suffer from credit supply shocks (see, for example, Ivashina and Scharfstein (2010) and Cornett, McNutt, and Tehranian (2011) for U.S. and Maddaloni and Peydro (2011) for the euro area and U.S).

balance sheet. Foreign banks from non-affected countries stop lending to firms in the affected economy due to limited enforcement of debt contracts that increases the cost of default in bad times. As a result of the drop in asset prices, the initial shock to domestic banks' balance sheet spreads internationally. Hence foreign banks' net worth also falls and as such they also need to shrink their balance sheet. This in turn leads to rising financing costs in both financially integrated countries. All these mechanisms reinforce each other and lead to a higher synchronization of economic activity between financially integrated countries.

2.3 Empirical Evidence

Most empirical studies document a positive correlation between financial integration and GDP co-movement.[10] Using cross-country data over a long period, Kose, Prasad, and Terrones (2004) find that financially open countries without capital account restrictions have more synchronized business cycles with world output. Imbs (2006) uses bilateral (country-pair) data on equity and debt holdings constructed by the IMF on a large cross-section of countries and shows a significant positive correlation between bilateral portfolio holdings and output synchronization. Similarly Otto, Voss and Willard (2001) find that OECD countries with strong FDI linkages have more similar cycles.[11] While examining the cross-sectional data patterns is the natural first thing to do, these type of cross-sectional correlations though informative do not identify causal effects, as they might be driven by common global shocks and/or unobserved country-pair heterogeneity. Another problem with most previous works is that they pool developed, emerging, and under-developed countries in the estimation. Theoretically this is far from ideal, as these countries experienced different types of shocks in the past three decades (for example industrial countries did not experience major financial crises till 2007, while emerging and underdeveloped economies experienced many currency and banking crises); and the parallel work examining the effect of trade integration on business cycle synchronization suggests that there are fundamental differences between advanced and emerging/underdeveloped countries (Kraay and Ventura (2000, 2007); Calderon, Chong, and Stein (2007)).

Morgan, Rime, Strahan (2004) show that banking deregulation in the U.S. over late 1970s

[10] For the broader literature that quantifies the effects of financial integration on economic growth, volatility, and risk sharing, see Bekaert, Harvey and Lundblad (2005, 2006, 2011); Bekaert, Lundblad, Siegel (2007); Henry (2000); Prasad, Kose, Rogoff, and Wei (2009); Kalemli-Ozcan, Sørensen and Volosovych (2010).

[11] The only study to our knowledge that documents a negative association between financial integration and synchronization is Garcia-Herrero and Ruiz (2008). These authors use capital account data for Spain and document a lower GDP synchronization of Spain with countries that Spain has strong financial linkages.

and early 1980s dampened economic volatility and made state business cycles more alike. They interpret their findings as suggesting that bank capital supply shocks were the dominant source of output fluctuations during this period in the U.S. Our results are in contrast with those of Morgan, Rime, Strahan (2004). We think the difference is due to our sample of developed European countries which under all accounts did not experience major credit shocks (with the exception of Scandinavian banking crisis) during our period of study, $1978 - 2006$.[12]

3 Data

3.1 BIS Data

Our dataset comes from the confidential version of BIS International Locational Banking Statistics Database. This database reports asset and liability holdings of banks located in roughly forty (mainly industrial) countries ("the *reporting area*") in more than one hundred and fifty countries (the "*vis-a-vis area*") at a quarterly frequency since the end of 1977. Yet, half of these countries started reporting only recently (mostly after 2000). Our panel dataset consists of annual bilateral data from and to eighteen rich economies over the period $1978 - 2006$.[13] These countries are: Australia, Austria, Belgium, Canada, Switzerland, Germany, Denmark, Spain, Finland, France, United Kingdom, Ireland, Italy, Japan, Netherlands, Portugal, Sweden, and the United States.[14]

The data is originally collected from domestic monetary authorities and local supervisory agencies, which in turn pass the data to the BIS which then performs a series of cross-country and consistency checks. The supervisory data include all of banks' on-balance sheet exposure and reflect more than 99% of the overall international exposure of a country's banking institutions. The data captures mainly international bank to bank debt, such as inter-bank credit lines, loans and deposits. Assets include mainly deposits and balances placed with non-resident banks, including bank's own related offices abroad. They also include holdings of securities and participations (i.e.

[12] It is plausible that for American states during 1980s credit supply shocks did play a bigger role compared to European countries throughout the last three decades. In fact preliminary analysis show that when we focus on the banking crisis of Scandinavian countries in the late 1980s, we do get a positive relation between banking integration and business cycles, consistent with the findings of Morgan, Rime, Strahan (2004).

[13] We prefer to use annual data given the noisy nature of quarterly data (though this has no effect on our results). Cross-border capital (or trade) flows data usually have gaps that make logarithmic transformations questionable. This is not the case in our data. There are only a few missing observations, mainly in the initial years (as some countries like Spain and Finland start reporting in 1983).

[14] In the previous version of the paper we also included Luxemburg and Greece. We dropped Luxemburg because the international position of banks in and from Luxemburg is extremely high. We also dropped Greece because data become available only after 2003. Including these countries does not affect our results.

permanent holdings of financial interest in other undertakings) in non-resident entities. Data also include trade-related credit, arrears of interest and principal that have not been written down and holdings of banks own issues of international securities. The data also cover bank's investment in equity-like instruments as well as foreign corporate and government bonds.

The BIS dataset does not distinguish between inter-bank debt activities and portfolio equity investment of banks. Yet the data mainly reflect debt holdings and flows. BIS (2003a,b) and Wooldridge (2002) argue that while FDI and equity have become more important after the late nineties, their weight is still quite small as standard banking activities consist bulk of cross-border holdings. International bank M&A activity and direct lending to foreign residents have been limited overall (see Lane and Milesi-Ferretti (2008)). According to our calculations based on the unilateral (at the country-time level) data of Lane and Milesi-Ferretti, debt flows reflect 67% of the total flows between $1978-2006$ for our group of countries; with equity and FDI jointly account for a third of total foreign investment. Banking activities in particular account for half (48.5%) of total foreign holdings and flows in 2006. For most of the 28 year period they accounted for around 60%.

The BIS data is expressed originally in current USD. We convert the data into constant USD by deflating the series with the U.S. CPI. Following previous works we use the total amount of the stock of external assets and liabilities and construct two quantity-based measures of financial integration. The first measure ($BANKINT1$) is the average value of (the logs of) real bilateral asset and liability holdings normalized with the sum of the population of the two countries. The second measure ($BANKINT2$) is the average of (the logs of) real bilateral asset and liability holdings as a share of the two countries' GDP.[15]

3.2 Measures of Synchronization

We construct three different measures of business cycle synchronization ($SYNCH_{i,j,t}$) using GDP data from the latest update of World Bank's World Development Indicator's Database (WB WDI). First, following Giannone, Lenza, and Reichlin (2008), we measure business cycle synchronization with the negative of divergence, defined as the absolute value of real GDP growth differences between country i and j in year t.

[15]In the previous version of the paper we experiment with other proxy measures of financial integration, using transactions data. The results are similar. We report data based on holdings (rather than flows/transactions) because theory and previous empirical works focus on the outstanding stock of international investors (banks in our application).

$$SYNCH1_{i,j,t} \equiv -\left|(\ln Y_{i,t} - \ln Y_{i,t-1}) - (\ln Y_{j,t} - \ln Y_{j,t-1})\right| \tag{1}$$

Second, we follow Morgan, Rime, and Strahan (2004) and construct $SYNCH2_{i,j,t}$ as follows. First, we regress real GDP growth on country fixed-effects and year fixed-effects.

$$\ln Y_{i,t} - \ln Y_{i,t-1} = \gamma_i + \phi_t + v_{i,t} \; \forall \; i, j$$

The residuals ($v_{i,t}$ and $v_{j,t}$) reflect how much GDP growth differs in each country and each year compared to average growth in this year and the average growth of this country over the estimation period. We then construct the business cycle synchronization proxy as the negative of the absolute difference of residual GDP growth:

$$SYNCH2_{i,j,t} \equiv -|\nu_{i,t} - \nu_{j,t}| \tag{2}$$

Intuitively this index measures how similar GDP growth rates are between two countries in any given year, accounting for the average growth in each country and the average growth in each year.

These two indicators are simple, intuitive, and easy-to-grasp. In contrast to the correlation measures that cross-country studies mainly work with, the above indices are not sensitive to various filtering methods that have been criticized on many grounds (e.g. Canova (1998, 1999)). They also do not contain estimation error. Again differently from the correlation measure, these indices do not directly reflect the volatility of output growth and, therefore, allows us to identify the impact of banking integration on the covariation of output growth. Doyle and Faust (2005) underline the importance of a synchronization measure that (ideally) does not include volatility. Isolating the covariance part is desirable, because, over the past two decades, global output volatility has fallen considerably in the industrial economies (e.g. Cecchetti, Flores-Lagunes, and Krause (2006)). Nevertheless, for comparison purposes, we follow previous cross-country studies and also estimate the 5-year correlation of the cyclical component of output as measured with Baxter and King (1999) Band-Pass filter $(2, 8; SYNCH3_{i,j,t})$ (e.g. Imbs (2006); Baxter and Kouparitsas (2005)).

3.3 Descriptive Statistics

Table 1 gives descriptive statistics for the main variables employed in the empirical analysis. The average divergence in real GDP growth rate is 1.78% ($SYNCH1$). Once we control for country

and year fixed-effects ($SYNCH2$) the differences are somewhat smaller (mean of 1.56%). Both synchronization indicators exhibit significant variation both across country-pairs and over time (the standard deviation is 1.56% and 1.42% respectively). The average correlation of the cyclical component of GDP ($SYNCH3$) over this time period is 0.42 and has considerable variation (the standard deviation is 0.50).

Figure 1 gives a graphical illustration on the evolution of the average (across country-pairs) value of the three measures of business cycle synchronization over the 28 years of our examination. Growth divergence measures, $SYNCH1$ and $SYNCH2$, are plotted on the left y-axis; the correlation measure, $SYNCH3$, is tabulated on the right y-axis. Clearly, there is a considerable degree of short-term variability which is quite useful in our empirical exercise. Overall output synchronization has been steadily increasing according to all measures since the mid-1980s (see also Kose, Otrok, and Prasad (2008) and Rose (2009)). The average correlation of the cyclical component of GDP ($SYNCH3$) was around $0.1 - 0.3$ in the 1980s. In the 1990s the correlation increased on average to 0.4, while in the 2000s the correlation reached $0.6 - 0.7$, before falling to around 0.5 before the recent crisis. Likewise, average differences in real GDP growth in the late 1970s and the 1980s were in the range of $2.5\% - 3.5\%$, while after the late 1990s the average difference fell to $1\% - 1.5\%$.

Figure 2 plots the evolution of cross-border banking holdings in the period $1978 - 2006$. Cross-border bank holdings have increased considerably over the past three decades. Lane and Milesi-Ferretti (2007) document similar patterns for other types of cross-border investment flows, such as FDI and equity. Yet international banking activities are by far the largest component of foreign capital holdings/flows. Figure 2 shows that real international bilateral bank holdings (per capita) have increased from an average value (across the 153 country-pairs of our sample) of roughly 170 dollars to almost $1,600$ dollars per person as of the end of 2006.

4 Banking Integration and Business Cycle Synchronization

4.1 Econometric Specification

We start our analysis estimating with OLS variants of the following specification:

$$SYNCH_{i,j,t} = \alpha_{i,j} + \alpha_t + \beta BANKINT_{i,j,t-1} + \mathbf{X}'_{i,j,t-1}\Psi + \varepsilon_{i,j,t} \tag{3}$$

$SYNCH_{i,j,t}$ is one of the three synchronization indices that measures the co-movement of output between countries i and j in year t. $BANKINT_{i,j,t-1}$ is one of our two measures of cross-border banking integration between countries i and j in the previous year/period $(t-1)$.[16] The specification also includes year/time (α_t) and country pair fixed-effects $(\alpha_{i,j})$. The year/time fixed-effects account for the effect of global shocks and other common time-varying factors that affect both business cycle patterns and banking integration. The year fixed-effects also account in a flexible non-parametric way for the overall fall in output volatility over our sample period. The country-pair effects account for hard-to-measure factors such as cultural ties, informational frictions, political coordination and other time-invariant unobservable factors, all of which have been shown to have an effect on both financial integration and business cycle patterns. Vector $\mathbf{X}'_{i,j,t-1}$reflects other country-pair time-varying factors, such as trade, specialization, etc.

4.2 Cross-Sectional Estimates

Table 2 presents cross-sectional and panel fixed-effects estimates on the effect of banking integration on GDP synchronization. For comparability with previous studies analyzing the correlation between financial integration and output synchronization, we start our analysis in Panel A by estimating cross-sectional models that pool the time series observations across all country pairs. The "between" estimator removes the time dimension by averaging the dependent and the explanatory variable across country-pairs. Thus for these models we have a single observation for each country-pair.

Columns (1)-(4) report cross-sectional estimates using synchronization in GDP growth rates ($SYNCH1$ and $SYNCH2$) as the dependent variable. The cross-sectional coefficient on the two banking integration measures is positive and significant at the 99% confidence level in all permutations, a result in line with previous cross-country empirical works. The estimates imply that across the 153 pairs of industrial countries in our sample, there is higher covariation of GDP growth among economies with stronger financial ties.

The specifications in columns (5)-(8) report estimates using the cyclical component of GDP ($SYNCH3$) estimated over a 5-year period as the dependent variable. These models are estimated in six non-overlapping 5-year periods. The unconditional coefficient estimates on banking integration reported in (5) and (7) continue to be positive and significant, implying that countries with stronger financial linkages have more correlated output cycles.

[16]We use lagged values to partly account for reverse causation. We also estimated specifications using contemporaneous values of financial/banking integration finding similar (and if anything stronger) results. We formally deal with reverse causation and other forms of endogeneity in the sections 5 and 6.

In columns (6) and (8) we examine whether our results reflect differences on trade intensity and industrial specialization. To control for differences in trade intensity, we use the log of bilateral real (deflated with the U.S. price deflator) exports and imports as a share of the two countries' GDP. Following Krugman (1991) and Kalemli-Ozcan, Sørensen and Yosha (2003), among others, we measure specialization with an index that reflects how dissimilar industrial production is in manufacturing ($SPEC_{i,j,t} \equiv \sum_{n=1}^{N} \left| s_{i,t}^{n} - s_{j,t}^{n} \right|$, where $s_{i,t}^{n}$ and $s_{j,t}^{n}$ denote the GDP share of manufacturing industry n in year t in country i and j respectively). A priori it looks important to account for differences in bilateral trade when working with long-term data as trade in goods and financial services tend to move in tandem (e.g. Rose and Spiegel (2004)) and previous studies show that trade has a significantly positive effect on business cycle synchronization (e.g. Frankel and Rose (1998)). Likewise accounting for specialization patterns seems important as financial integration affects specialization patterns (e.g. Obstfeld (1994); Kalemli-Ozcan, Sørensen, and Yosha (2001)). In line with previous studies, trade enters with a positive estimate. The regressions further show that countries with dissimilar production structures have less synchronized cycles; yet this effect is not statistically significant, most likely because of the limited variability of the specialization index over a 5-year horizon. Most importantly for our focus, the estimate on $BANKINT$ continues to be at least two standard errors above zero in both permutations.[17]

4.3 Panel Fixed-Effect Estimates

In Table 2, Panel B we report otherwise identical specifications to Panel A, but we add country-pair fixed-effects and time fixed-effects in the empirical model (as shown in equation (3)). Due to serial correlation, standard errors in the panel models in Panel B (and all subsequent tables) are clustered at the country-pair level (Bertrand, Duflo, and Mullainathan (2004)). This method allows for arbitrary heteroskedasticity and autocorrelation for each country pair.[18] The panel estimates in Panel B stand in contrast to the cross-sectional coefficients in Panel A. In all perturbations with the annual data reported in columns (1)-(4) the estimate on banking integration enters with the opposite sign to the cross-sectional specifications. The panel fixed-effect models imply that a higher level of international banking integration is associated with a lower degree of output synchronization. This

[17] When we control for trade intensity and differences in industrial specialization we lose roughly 35% of our sample due to data unavailability on the industrial statistics needed to construct $SPEC$. We thus also augmented the empirical model with trade and specialization one at a time, obtaining similar results.

[18] Newey-West standard errors that allow for common across country-pairs auto-correlation are similar (and if anything somewhat smaller) compared to clustered at the country-pair dimension standard errors. We also estimated standard errors with the multi-way clustering method of Cameron, Gelbach, and Miller (2006) clustering at the year t, country i and country j, finding similar results.

result is present with both banking integration measures and both synchronization indicators. In columns (5)-(8) we estimate panel fixed-effects models using the correlation of the cyclical component of GDP estimated over 5 non-overlapping five-year periods as the dependent variable. Again there is a sharp difference between the cross-sectional and the within country-pair estimates. The estimates in columns (6) and (8) show that this result is not driven by changes on goods' trade and changes on industrial structure.

As a result, while in the cross-section there is a positive association between output co-movement and financial integration, as financial linkages become stronger within country-pairs over time output growth rates diverge. (Appendix Figures 1 and 2 give a graphical illustration of the sharp differences in the correlation between financial integration and output synchronicity). The striking difference between the cross-sectional and the panel estimates suggests that omitted variable bias arising from common global time-varying shocks and hard-to-account-for country-pair characteristics was plaguing estimates in previous cross-sectional studies.

4.4 Further Evidence and Sensitivity Analysis

In Appendix Table 1 we explore further the underlying reasons behind the sharp difference in the cross-sectional and the within country-pair correlation between financial integration and output synchronization. In Panel A we report specifications with annual data adding only year constants. In all permutations the coefficient on banking integration is positive and highly significant, implying that solely accounting for common to all countries shocks does not suffice to switch the sign of the estimate. Yet the coefficients on banking integration drop by half as compared to the analogous estimates in Panel A of Table 2, where we were not accounting for common shocks. This shows that accounting for common global factors is economically important. In Panel B we omit year fixed-effects and add country-pair fixed-effects. To account for the upward trend in banking integration, we also add country-specific time trends. The coefficient on banking integration turns negative and is highly significant. This suggests that accounting for hard-to-observe country-pair fixed factors is fundamental. In Panel C illustrates the robustness of the significantly negative within country-pair correlation between financial integration and output synchronization. In these specifications we include year fixed-effects and country-specific linear time trends on top of country-pair fixed-effects. The coefficient on lagged banking integration continues to be statistically significant at standard confidence levels.

A potential drawback of the correlation measure ($SYNCH3$) is that it is estimated over a

short (five-year) period. Thus we re-estimated the panel specifications splitting the sample into two periods and used as the dependent variable the correlation of the cyclical component of GDP estimated over each 14-year period. Appendix Table 2 reports the results. Panel *A* gives cross-sectional estimates while Panel *B* reports country-pair fixed effects estimates with a period constant. The results are in line with columns (5)-(8) of Table 2 and, if anything, stronger. The estimate on banking integration in the beginning of each of the two 14-year periods is statistically significant at the 1% level. This suggests that increases in cross-border banking activities have been associated with less synchronized output cycles.

We performed additional sensitivity checks to investigate the stability of our OLS estimates that reveal a striking difference between the cross-sectional and the over time within country-pair correlation of banking integration and output synchronization. Among others, we checked whether our results are driven by influential observations. The change in the sign of the coefficient on banking integration is not due to any particular country-year observations. We also estimated a weighted least square (WLS) by population and GDP regression to guard against the influence of small country pairs, obtaining similar results. We also used unstandardized measures of banking integration and controlled directly for population and/or GDP, again finding similar results. In the previous version of the paper we also estimated auto-regressive specifications, controlling for inertia in business cycle synchronization (though differences in GDP fluctuations are not particularly persistent; the first auto-regressive coefficient is around 0.15). Again the results are similar.

4.5 Open Issues

Our results show a strong negative effect of banking integration on business cycle synchronization in a panel of industrialized countries during tranquil times. Although this result is quite robust to a variety of sensitivity checks, the OLS coefficients do not capture the one way effect of financial integration on output synchronization.

A first concern emerges from potential omitted variables. Most of the robust correlates of business cycle synchronization identified previously are time-invariant and, hence, our country-pair fixed-effects account for these factors (Baxter and Kouparitsas (2004)). Inclusion of time effects also mitigates concerns that our estimates are driven from a common possibly trending omitted variable. Nevertheless, we cannot completely rule out that an omitted time-varying country-pair factor may affect both output synchronization and banking integration.

Second, there is the possibility of reverse causation. This type of endogeneity may arise if

banking integration is the outcome rather than the cause of business cycle divergence. To partly account for this possibility, in our panel estimates we have used lagged values of banking integration (and the other controls). Given the low persistence of output co-movement, employing lagged values is reasonable. Yet, clearly it is not ideal.

Third, there are worries that measurement error may affect the LS. While the BIS statistics capture all cross-border banking activities and thus classical error-in-variables is negligible, our data does not include other types of international investment, such as portfolio investment by non-banks and FDI. Since there is a high correlation between equity flows and debt flows, this concern is not severe in our context.[19] A probably more important problem is that our data (as all data on cross-country investment) miss banking activities channeled via small off-shore financial centers.

5 Financial Sector Legislative-Regulatory Harmonization

In this section we construct a structural index of financial integration that reflects regulatory/legislative harmonization reforms in financial services across Europe that allows to account for these concerns.

5.1 De-jure broad measure of financial integration

We construct a structural measure of financial integration using data on financial sector harmonization policies across EU15 countries on the implementation of the legislative acts of the Financial Services Action Plan. The FSAP was a major policy initiative launched in 1998 by the EU Commission and the EU Council (the two main bodies of the European Union) that aimed to remove regulatory and legislative barriers across European countries in financial intermediation. Besides technical recommendations and communications, the FSAP included 29 major pieces of legislation, 27 EU Directives and 2 EU Regulations. The FSAP included legislation on securities markets (e.g. the Prospectus Directive and the Directive on Insider Trading), corporate governance (e.g. the Transparency Directive and the Takeover Bids Directive), banking (e.g. Directive on Capital Adequacy), and insurance (e.g. the Solvency Directive), among others.[20] Until the official completion

[19] According to the latest vintage of the Lane and Milesi-Ferretti dataset of aggregate (at the country-level) foreign holdings, the correlation of total debt, portfolio debt, banking, FDI and equity in levels (either expressed as a share of total assets or as a share of GDP) is the range of $0.75 - 0.99$. In first differences the correlation weakens, but is always larger than 0.50. Country-pair datasets on foreign capital holdings also suggest a strong correlation of the various types of international investment. For example, Kubelec and Sa (2009) document that the correlation between our BIS data and CPIS bilateral debt data, which has a broader coverage of debt assets and liabilities, is 80%.

[20] Malcom *et al.* (2009) and Enriques and Gatti (2008) give details on the FSAP and the transposition of EU financial legislation into national law.

date at the end of 2003 the EU Commission had passed 21 of these measures. The remaining 6 Directives of the FSAP passed in the period $2004 - 2006$.

In contrast to EU Regulations that become immediately part of the legal order of all EU member countries, EU Directives are legal acts that do not become immediately enforceable across the EU. Instead, member countries are given time to adopt, modify, and eventually transpose the EU Directives into domestic law. As with other pieces of EU-initiated legislation, there is a great deal of heterogeneity on the speed with which European countries adopted the FSAP Directives (see Supplementary Appendix Tables A and B). The time of the transposition/adoption of EU Directives takes many years, as EU member states delay the adaptation for various reasons, such as parliamentary delays, because new agencies need to be established, existing laws be removed, and due to many other technical obstacles. Moreover member states may delay to adopt the EU law to shield domestic firms from foreign competition and other political considerations. For example, in our context only four EU countries (Denmark, France, Finland and the UK) converted into the domestic legal order the "Directive on the Supervision of Credit Institutions, Insurance Undertakings and Investment Firms in a Financial Conglomerate" within the first two years since its circulation (in November 2002) by the EU Commission. Instead, it took five years for the Netherlands and Sweden to adopt this important financial legislation, while one country (Portugal) had not transposed the Directive till the end of our sample period (end of 2006). We use the transposition timing across member states to construct a time-varying structural measure of financial integration for each country-pair.

We construct the bilateral legislative-regulatory harmonization index as follows: First, we define 27 indicator variables ($LEX^k_{i,j,t}$, one for each FSAP Directive k) that equal one if at any given year both countries in each country-pair cell have transposed each EU Directive into national law, and zero otherwise. Second, we create the country-pair time-varying legislative harmonization measure by summing the values of these 27 indicator variables ($LEX^k_{i,j,t}$). Since the variable is highly skewed in the regressions we use the log value, i.e., $HARMON_{i,j,t} \equiv \ln\left(\sum_{k=1}^{K=27} LEX^k_{i,j,t}\right)$.

The legislative/regulatory harmonization index reflects how similar are the structures governing financial intermediation among EU member countries. Thus one could think of this measure as a de-jure index of financial integration, similar in spirit to cross-country integration measures based on the removal of capital account restrictions (e.g. Quinn (2003)) and the liberalization of equity market investment (e.g. Bekaert, Harvey, and Lumsdaine (2002)). The harmonization index in financial services is also similar in spirit to measures dating banking deregulation policies across

U.S. states (e.g. Jayarante and Strahan (1997)). Yet in contrast to these works that produce country (or state) level indicators of financial integration, the harmonization index we construct exhibits country-pair-time variation as it reflects the situation when two countries have adopted the *exact* same regulatory legislation in financial intermediation.

5.2 Harmonization in Financial Intermediation and Business Cycle Synchronization

In Table 3 we examine the effect of legislative-regulatory harmonization policies in financial services on output synchronization. The estimate on $HARMON_{i,j,t-1}$ in column (1) is negative and highly significant. This suggests that conditional on time-invariant country-pair factors and common to all countries time-varying factors, harmonization policies in financial services have lead to a lower degree of output growth co-movement.

In column (2) we control for differences in the exchange rate regime. This is important as there is the possibility that the legislative/regulatory harmonization index in financial services captures (partly at least) the effect of monetary unification that occurred around the same time as the launch of the FSAP. To do so we exploit the recent update of the de-facto exchange rate regime classification of Reinhart and Rogoff (2004) by Ilzetzki, Reinhart, and Rogoff (2008). The Reinhart and Rogoff "coarse" classification ranges from 1 to 5 where lower values suggest a more rigid regime. For example, euro area countries get a score of 1 after 1999 and a score of 2 in the 1990s, when they were participating in the European Exchange Rate Mechanism. Using this dataset we construct a bilateral index by taking the sum of the log classification of countries i and j in the beginning of each year t ($ERC = \ln(ER_{i,t}) + \ln(ER_{j,t})$). The exchange rate flexibility index enters with an insignificant estimate, while the structural index of financial integration that reflects regulatory-legislative harmonization policies in financial services continues to enter with a highly significant coefficient.

In column (3) we include the lagged log level of the product of GDP of countries i and j to account for the possibility that our estimates are driven by countries receiving a lot of foreign bank capital, while converging to a new steady state. Including the lagged log level of GDP also allows us to account for the cyclical properties of international business cycle synchronization (there is an increased degree of synchronization in turbulent times). This has little effect on our main result. The coefficient on the structural index of financial integration continues to be negative and more than four standard errors below zero.

To further account for the potential confounding effect of European Monetary Union (EMU) in column (4) we augment the specification with two dummy variables that take on the value one when one of the two countries is a member of the EU or the euro area in each year and zero otherwise; and two indicators that switch to one when both countries are members of the EU or the euro area (and zero otherwise). The coefficient on legal-regulatory integration in financial services drops in absolute value, but it retains significance at the 5% level.

In column (5) we add country-specific linear trends so as to account for unobserved country patterns in financial integration and output fluctuations. While these specifications may be too restrictive, the bilateral regulatory/legislative harmonization index in financial services continues to enter with a negative and significant estimate.

The quantitative impact of these estimates is significant. For one standard deviation increase in our harmonization index (corresponding to a simultaneous adoption of 4 laws), an estimate of -0.2 explains 30 percent of the actual change in synchronization over our sample period, conditional on all the fixed effects.

One may be worried that the highly significant effect of legislative/regulatory harmonization policies on output synchronization is driven by hard-to-account-for factors distinguishing the recent period of financial globalization with the eighties where cross-border capital flows were small. Thus, in columns (6)-(10) we report otherwise similar to columns (1)-(5) specifications focusing only in the period $1995 - 2006$. While we lose efficiency, in all permutations the structural measure of financial integration enters with a highly significant negative coefficient.

The estimates in Table 3 advance on the causality front. So far most of the literature on international financial integration has relied either on quantity, such as international holdings (e.g. Imbs (2006)) or price-based measures, such as the correlation of equity returns (e.g. Bekaert and Harvey (1995)). In contrast to these outcome measures, the legislative-regulatory harmonization index reflects structural features of the regulatory and supervisory system that governs financial intermediation; as such, reverse causation is quite unlikely to drive the significant negative correlation shown in Table 3. Moreover, since legislative transposition policies in converting the EU Directives into the national legal order are unilateral (at the country level), while the harmonization index is *bilateral* reflecting the situation when two countries have adopted the *exact* same piece of financial legislation, these specifications are unlikely to be driven by other forms of endogeneity.

In Appendix Table 3 we examine the robustness of the negative effect of legislative/regulatory harmonization policies in financial services on output synchronization. The literature on the deter-

minants of world market segmentation (e.g. Kose *et al.* (2008); Bekaert *et al.* (2011)) has explored the effect of various institutional and financial development indicators (such as creditor's rights, property rights institutions, private credit, etc.). Since most of the usual proxies of institutional efficiency exhibit little within country variability, they will be captured by the country-pair fixed-effects. Appendix Table 3, columns (1)-(2) show that it is the bilateral adoption of the various legislative acts of the FSAP that correlate with output synchronization rather than the unilateral (country-specific) transposition of Directives into national law. In columns (3)-(6) we control for two usually employed measures of financial development, stock market turnover and stock market capitalization in countries i and j. The negative effect of the structural index of financial integration retains its economic and statistical significance.

6 Instrumental Variables Estimation

Having established a significant relationship between the structural measure of financial integration and output synchronization (in Table 3) and a similarly negative association between the de-facto quantity-based measure of banking integration and output synchronization (in Table 2), the next natural step is to combine the two results in an instrumental variables setting.

6.1 Identification

We posit the following first-stage relationship between legislative-regulatory harmonization policies in financial services ($HARMON$) and cross-border banking integration ($BANKINT$):

$$BANKINT_{i,j,t} = \delta_{i,j} + \delta_t + \gamma HARMON_{i,j,t} + X'_{i,j,t}\Phi + \nu_{i,j,t} \tag{4}$$

The index of legislative harmonization policies in financial services ($HARMON$) will serve as a valid "excludable" instrument if: *a*) It is significantly correlated with banking integration, i.e. there is a strong first-stage relationship. *b*) Conditional on other factors legislative/regulatory harmonization policies in financial services affect business cycle synchronization through cross-border financial integration (i.e. $COV(HARMON_{i,j,t}, \varepsilon_{i,j,t}|X'_{i,j,t}, \alpha_i, \delta_t) = 0$ where $\varepsilon_{i,j,t}$ is the error term in the second stage (equation 3)).

Our identification scheme links policy changes in a particular aspect of law (financial intermediation harmonization) with outcomes in exactly the same industry. Thus the key exclusion

restriction for instrument validity seems plausible, because legislative harmonization policy reforms in financial services should affect the patterns of business cycle co-movement primarily by altering cross-border financial activities (see Angrist and Pischke (2008)). FSAP was designed to spur cross-border financial linkages and develop a single market for financial services in Europe. Thus conditional on other bilateral characteristics it seems reasonable that harmonization policies in financial services affect output synchronization through increasing bilateral financial linkages.

Conceptually our identification builds on insights of the law and finance literature. This body of work shows that differences in the legal protection of shareholders and creditors have first-order effects on the development of deep and efficient financial markets and intermediaries (see La Porta, Lopez-de-Silanes, Shleifer, and Vishny (1997, 1998)). Of most relevance is the study of La Porta, Lopez-de-Silanes, and Shleifer (2008), who compile a detailed cross-country dataset of securities laws across countries and then examine the impact of such regulations on capital markets. Our identification set-up is, however, more restrictive and thus stronger since we link country-pair reforms in legal practices that aim to make the functioning of the financial system more alike with bilateral changes in financial patterns.

The country-pair dimension of the harmonization index further alleviates concerns of endogeneity, emerging either from reverse causation or because the instrument is correlated with omitted variables. While the timing of the transposition of the EU Directives into the domestic law may be related to hard-to-account-for unilateral (domestic) conditions, the outcomes we study—financial integration in the first-stage and output synchronization in the second-stage—are bilateral (and time-varying).[21] Thus to challenge the exogeneity assumption one would require that countries coordinate on the exact timing of each piece of legislation, something that does not seem to be the case.

Someone might be worried from anticipation of these regulatory reforms. Yet in practice anticipation effects are not particularly important in our context. First, even if investors have some idea on the timing of the legal adoption of each EU Directive in their country, it is quite unlikely that they can also foresee when another country will adopt the exact same Directive. Second, since most Directives reduce the cost of cross-border financial intermediation after their adoption, it makes sense for banks to wait for the transposition of the EU laws. Take for example the Settlements Directive that introduced central party clearing, legal enforceability of netting and collateral security. Transaction costs and counter-party risk reduce only when both countries transpose the EU

[21] We investigated whether the legal adoption of the FSAP Directives correlates with country-level GDP growth, finding insignificant estimates.

Directive into the domestic legal order. Third, if foreign banks increase their lending and borrowing in anticipation of the legal adoption of the EU Directives, then we should not detect a significant first-stage relationship, something we do (see below).

6.2 First-Stage: Legislative-Regulatory Harmonization in Financial Services and Banking Integration

In Panel B of Table 4 we examine whether the transposition of EU laws on financial intermediation are relevant for cross-border banking activities (first-stage). We continue to include country-pair fixed-effects and year fixed-effects, so the coefficient on the harmonization index measures how much financial integration increased/decreased after countries adopt into the local legal order the exact same pieces of financial laws. The coefficient on $HARMON$ in column (1) is positive (0.41) and significant at the 99% confidence level. This suggests that countries that quickly incorporated into domestic law the EU-wide regulatory-legislative harmonization policies in capital markets, insurance, and banking became more financially integrated through international banking activities.

Figure 3 illustrates this using as an example the evolution of banking activities and legislative/regulatory harmonization in financial services between Spain and Netherlands. Banking activities between Spain and the Netherlands increase significantly after 1999 when alongside euro membership both countries adopt at the same time the first Directive of the FSAP on Settlements. Cross-border banking activities further increase in 2002, when both countries adopt at the same time the EU Directives that harmonized insurance services and electronic payments (see Appendix Tables A and B).

In column (2) we control for differences in GDP. This has no effect on the coefficient on the structural index of financial integration. In column (3) we add in the specification a time-varying bilateral index capturing the flexibility of the exchange rate regime. This index enters with a negative and significant estimate suggesting that banking activities have increased significantly among pairs of countries that have adopted more rigid currency regimes.[22] The coefficient on the harmonization index falls somewhat, but retains significance at the 99% level. To further alleviate concerns that the harmonization index in financial services captures other aspects of EU integration, in column (4) we augment the specification with two indicator variables that switch to one if both

[22]This finding fits with the evidence from the fear of floating literature (e.g. Calvo and Reinhart (2002); Gelos and Wei (2005)). This research argues that to attract foreign capital, emerging economies are unwilling to let their currencies float; and even when monetary authorities in developing countries argue that they do not manage the currency in practice they do so (Reinhart and Rogoff (2004)). While this body of work focuses on developing economies, our evidence shows a similar pattern across developed countries.

countries are members of the EU and the euro area and two indicator variables that equal one if one of the two countries is a member of the EU or the euro area. The coefficient on $HARMON$ retains its statistical significance, suggesting that a considerable portion of the recent increase in cross-border banking activities among EU member countries was driven by the harmonization policies in financial services.[23]

In columns (5)-(8) we focus on the post 1995 period. While we lose efficiency, focusing in the period just before and after the introduction of the FSAP is useful to examine the robustness of our results. In all permutations the coefficient on the legislative/regulatory harmonization index is positive and highly significant.

The first stage estimates are in line with the literature in law and economics that argues that prior to FSAP financial market integration in the EU was still unachievable given the diversity of the legal regimes and the costs associated with this diversity (see Enriques and Gatti (2008) and Malcom *et al.* (2009)). While many argue that the FSAP could have included bolder harmonization measures, the elasticities in Panel B of Table 4 suggest a considerable economic effect; a one standard deviation increase in harmonization index, almost doubles the banking integration. In Kalemli-Ozcan, Papaioannou, and Peydró (2010) we show that the strong effect of legislative/regulatory harmonization policies in financial services in spurring cross-border activities is robust to a variety of permutations. Most importantly for our focus here, the first-stage fit is strong. Across all specifications in the full sample ((1)-(4)) the first-stage F-score of the excluded instrument (the legislative/regulatory harmonization index) is significantly larger than 10, the rule-of-thumb value that alerts for weak instrument problems (Staiger and Stock (1997); Stock, Wright, and Yogo (2001)). Even when we focus on the post 1995 period, the estimate of $HARMON$ is 3 standard errors larger than zero, suggesting a reasonable first-stage fit.[24]

6.3 2SLS Estimates

We now turn to the second-stage estimates that under instrument validity identify the one-way effect of financial integration on output synchronization.[25] Panel A of Table 4 reports the second-

[23] We also examined whether it is the joint adoption of EU Directives that fosters cross-border banking activities or the unilateral transposition by member countries. The estimates clearly show that it is legislative/regulatory harmonization that spurs cross-border banking activities (see Appendix Table 4).

[24] In our set-up the Stock and Yogo (2002) critical value for weak identification is around 16.4. 8.96, and 6.66 for critical values of 10%, 15%, and 20% respectively.

[25] The causal effect of banking integration on output synchronization is simply the ratio of the "reduced-form" coefficient of legislative-regulatory harmonization policies on output co-movement (reported in Table 3) to the "first-stage" coefficient of $HARMON$ on banking integration (reported in Panel B-Table 4).

stage coefficients. The 2SLS estimate of banking integration in column (1) is negative and highly significant. It suggests that increases in bilateral banking activities driven by legislative-regulatory harmonization policies in financial services lead to more divergent output patterns. The 2SLS coefficient on banking integration retains significance when we control for the product of the two countries GDP in column (2), which also enters with a significant estimate (not shown). The second stage estimate on $BANKINT$ retains significance when we control for the flexibility of the exchange rate regime (in (3)) and for EU and Euro area membership in column (4)). The estimates in column (4) imply that conditional on country-pair fixed-factors, common global effects, the flexibility of the exchange rate regime, EU and Euro area membership, and output convergence, the component of banking integration explained by harmonization policies in financial services is associated with a lower degree of output synchronization.

The 2SLS coefficients on banking integration are larger in absolute value than the LS estimates (in Panel B of Table 2). For example, the analogous LS estimate on banking integration to the 2SLS coefficient in column (1) is -0.385. The larger in absolute magnitude of 2SLS estimates suggest that the OLS estimates were contaminated by measurement error and that reverse causation was in practice not a fundamental problem. Specifically there are two main sources of attenuation in the OLS estimates that the 2SLS helps to resolve. First, bilateral banking activities are just one part of financial integration; although international banking activities are by far largest component of foreign investment, theoretical works suggest that the impact of other forms of financial integration, mostly equity investment and FDI, should have a larger impact on cross-border risk sharing and output co-movement than integration that takes the form of debt and direct lending (see Morgan, Rime, and Strahan (2004) and Davies (2009)). As the harmonization index that we use as an "instrument" for banking integration is much broader than banking, covering legislative convergence in all segments of financial intermediation (specifically in capital markets, insurance industry, company law) the larger second stage coefficients is not surprising. Second, attenuated OLS estimates may arise because a sizable portion of international investment and lending is redirected through financial centers (e.g. Kubelec and Sa (2009); Lane and Milesi-Ferretti (2007)) and thus standard measures of bilateral integration miss indirect linkages. Since our legislative-regulatory harmonization index is truly bilateral and not systematically biased for financial center countries (like Switzerland or the United Kingdom) it accounts for indirect transactions through financial centers.[26]

[26]Of course the larger in absolute magnitude 2SLS coefficient may arise because the harmonization index that we use as an instrument is correlated with relevant time-varying country-pair variables. This, however, seems unlikely, since most of the correlates of output synchronization and bilateral international capital holdings are either time-

7 Conclusion

Estimating the effect of financial integration on synchronization of economic activity is difficult given the multitude of identification challenges. To date, the central challenge for the literature has been the absence of time varying measures of bilateral financial linkages. By using such a unique supervisory data set, we construct time-varying de-facto and de-jure financial integration measures for developed country-pairs over last three decades. Our country-pair-time data set enables us to use a methodology that identifies the effect of financial integration on business cycle synchronization through within country-pair over time changes as opposed to cross-sectional differences as typically done in the literature. Our de-jure measure is exogenous, since it is based on changes in financial laws for *both* countries in the pair.

Why do we need country-pair-time varying measures of financial integration to identify its causal impact on business cycle synchronization? The answer lies in the following identification challenges. First, in a cross-section, a positive association between cross-border financial linkages and output comovement may reflect a spurious correlation due to many commonalities between countries. Countries closer geographically with significant economic ties and similar in other sociopolitical dimensions tend to have both more synchronized output fluctuations and higher degree of financial integration. Second, the response of integrated economies to common shocks will be similar and indistinguishable from contagion given the upward trends in integration and business cycle synchronization in the last three decades. Third, a significant negative association between financial linkages and business cycle synchronization may simply be driven by the fact that capital flows to high return/high growth countries. Fourth, measurement error in the bilateral data on international capital holdings might attenuate or may lead to systematic biases in the estimates. We argue that our methodology combined with our unique data on bilateral bank exposure and the de-jure exogenous measure of integration based on changes in financial intermediation can account for all these identification challenges, clearly demonstrating the negative effect of integration on bilateral output growth patterns, conditional on global shocks and country-pair unobserved heterogeneity.

Our findings require that we significantly reconsider the conventional wisdom. Contrary to the previous studies, we show that increased financial integration leads to divergent economic activity among country-pairs. These results are consistent with macro and finance models that highlight

invariant (e.g. distance, trust, cultural ties) or slow moving (e.g. specialization, trade). Thus they will be captured by the country-pair fixed-effects.

the dominant role of firm capital/productivity shocks over shocks to bank capital. The policy implications of our study are such that in the absence of a major worldwide crisis, developed country financial markets work as expected channeling the funds efficiently. The results can alter drastically in the event of a major shock to the financial system of a country such as the U.S.

8 Data Appendix

Synchronization Index 1 [$SYNCH1$]: The measure is defined as minus one times the divergence of (logarithmic) real GDP growth between each pair of countries in each year. $SYNCH1_{i,,j,t} \equiv -[(\ln Y_{i,t} - \ln Y_{i,t-1}) - (\ln Y_{j,t} - \ln Y_{j,t-1})]$. For output ($Y$) we use World Bank's real per capita GDP at constant prices series. This index follows Giannone, Lenza and Reichlin (2008). *Source: World Bank's World Development Indicators Database (2011).*

Synchronization Index 2 [$SYNCH2$]: The measure follows Morgan, Rime, and Strahan (2004) and is constructed in two steps. First, we regress (logarithmic) real GDP growth separately for each country on country fixed-effects and year fixed-effects, i.e. $\ln Y_{i,t} - \ln Y_{i,t-1} = \gamma_i + \phi_t + v_{i,t}\ \forall\ i, j$. Second, we construct the business cycle synchronization index as the negative of the divergence of the residuals for each country-pair, i.e. $SYNCH2_{i,j,t} \equiv -|\nu_{i,t} - \nu_{j,t}|$. *Source: World Bank's World Development Indicators Database (2011).*

Synchronization Index 3 [$SYNCH3$]: The measure is the correlation of the cyclical component of (logarithmic) real GDP as measured with Baxter and King (1999) Band-Pass filter $(2, 8)$. The index follows Baxter and Kouparitsas (2005). *Source: World Bank's World Development Indicators Database (2010).*

Banking Integration 1 [$BANKINT1$]: Banking integration index based on bilateral cross-border holdings (stocks) of banks. Data on bank's cross-border bilateral stocks of assets and liabilities come from the confidential version of BIS's Locational Banking Statistics. The BIS defines banking institutions broadly so "*reporting institutions should include not only commercial banks but also savings banks, savings and loan associations, credit unions or cooperative credit banks,building societies, and post office giro institutions, other government-controlled savings banks and other financial institutions if they take deposits or issue close substitutes for deposits*" (BIS 2003a,b). For each country-pair and year there are up to four observations. *i*) asset holdings (stocks) of banks located in country i in all sectors of the economy in country j; *ii*) asset holdings (stocks) of banks located in country j in all sectors of the economy in country i; *iii*) liabilities (stocks) of banks located in country i to country j. *iv*) liabilities (stocks) of banks located in country j to country i. The data is originally expressed in current U.S. dollars. First, we deflate the four series with the U.S. deflator. Second, we standardize the series by dividing asset and liabilities with the sum of the two countries population in each year (using data from World Bank's World Development Indicators Database). Third, we take the average of the log value of real bilateral assets and liabilities in each year. *Source: Bank of International Settlements, Locational*

Banking Statistics (2008).

Banking Integration 2 [$BANKINT2$]: Banking integration index based on bilateral cross-border holdings (stocks) of banks. Data on bank's cross-border bilateral stocks of assets and liabilities come from the confidential version of BIS's Locational Banking Statistics. The BIS defines banking institutions broadly so "*reporting institutions should include not only commercial banks but also savings banks, savings and loan associations, credit unions or cooperative credit banks,building societies, and post office giro institutions, other government-controlled savings banks and other financial institutions if they take deposits or issue close substitutes for deposits*" (BIS 2003). For each country-pair and year there are up to four observations. *i*) asset holdings (stocks) of banks located in country i in all sectors of the economy in country j; *ii*) asset holdings (stocks) of banks located in country j in all sectors of the economy in country i; *iii*) liabilities (stocks) of banks located in country i to country j. *iv*) liabilities (stocks) of banks located in country j to country i. The data is originally expressed in current U.S. dollars. First, we deflate the four series with the U.S. deflator. Second, we standardize the series by dividing asset and liabilities with the sum of the two countries GDP in each year (using data from World Bank's World Development Indicators Database). Third, we take the average of the log value of real bilateral assets and liabilities in each year. *Source: Bank of International Settlements, Locational Banking Statistics (2008).*

Trade Integration [$TRADE$]: Index of bilateral trade intensity. The measure is the log of bilateral real (deflated with the U.S. price deflator) exports and imports as a share of two countries's GDP. This measure follows Calderon, Chong, and Stein (2007). *Source: IMF's Direction of Trade Database (2008).*

Specialization [$SPEC$]: Index of industrial specialization, based on dissimilarities in production. The measure is the sum of the absolute differences in the share of industrial production for nine manufacturing sectors as a share of the total manufacturing production in each pair of countries in each year, i.e. $SPEC_{i,j,t} \equiv \sum_{n=1}^{N} \left| s_{i,t}^{n} - s_{j,t}^{n} \right|$. The index follows Krugman (1991), Imbs (2006), and Kalemli-Ozcan, Sørensen, and Yosha (2003). *Source: United Nations Industrial Statistics Database (2008).*

Legislative Harmonization in Financial Services [$HARMON$]**:** Index of regulatory-legislative harmonization in financial services based on the transposition of the EU Directives of the EU Financial Services Action Plan (FSAP). We construct the bilateral harmonization index in two steps. First, we define 27 indicator variables ($LEX_{i,,j,t}^{k}$, one for each Directive k) that equal one if at any given year both countries in each country-pair cell have transposed the Directive into national

law and zero otherwise. Second, we create the country-time varying legislative harmonization measure ranging by summing the values of these 27 indicator variables ($LEX^k_{i,,j,t}$). Since the variable is highly skewed in the regressions we use the log value, i.e., $HARMON_{i,j,t} \equiv \ln\left(\sum_{k=1}^{K=27} LEX^k_{i,,j,t}\right)$. *Source: Kalemli-Ozcan, Papaioannou, and Peydró (2010), based on data from the EU Commission and each EU15 member country.*

Exchange Rate Flexibility [ERC]**:** Bilateral index of the flexibility of the exchange rate, based on "coarse" regime classification of Reinhart and Rogoff (2004). The country-specific index ranges from 1 to 5 where lower values suggest a more rigid regime. We construct the bilateral index by taking the sum of the log classification of countries i and j in the beginning (January) of each year t ($ERC = \ln(ER_{i,t}) + \ln(ER_{j,t})$). *Source: Ilzetzki, Reinhart, and Rogoff (2008) and Reinhart and Rogoff (2004).*

Euro Area Both [$EZ2$]: Bilateral index of membership in the euro area. The measure is an indicator variable that takes on the value one if both countries are members of the euro-zone in year t and zero otherwise. *Source: European Central Bank.*

Euro Area One [$EZ1$]: Bilateral index of membership in the euro area. The measure is an indicator variable that takes on the value one if only one country is member of the euro-zone in year t and zero otherwise. *Source: European Central Bank.*

European Union Both [$EU2$]: Bilateral index of membership in the EU. The measure is an indicator variable that takes on the value one if both countries are members of the EU in year t and zero otherwise. *Source: EU Commission.*

European Union One [$EU1$]: Bilateral index of membership in the EU. The measure is an indicator variable that takes on the value one if only one country is member of the EU in year t and zero otherwise. *Source: EU Commission.*

Income [GDP]: Log level of real GDP (in constant U.S. dollars) for country i and country j in year t. In the regressions we use the log of the product of the two countries' GDP. *Source: World Bank World Development Indicators Database (2011).*

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Table 1: Descriptive Statistics

	Obs.	*mean*	*st. dev.*	*min*	*p25*	*p50*	*p75*	*max*
SYNCH1	4229	-1.78	1.56	-11.18	-2.44	-1.35	-0.63	0.00
SYNCH2	4229	-1.56	1.42	-12.09	-2.12	-1.19	-0.55	0.00
SYNCH3	3796	0.42	0.50	-0.99	0.13	0.59	0.83	1.00
BANKINT1	4229	588.12	1307.82	0	30.87	137.28	529.78	14693.05
BANKINT2	4229	0.03	0.05	0	0.00	0.01	0.02	0.57
HARMON	4229	0.96	3.68	0	0	0	0	22
ERC	4229	4.37	1.57	2	3	4	5	10
TRADE	4229	0.01	0.02	0	0.00	0.01	0.02	0.27
SPEC	2291	1.78	1.15	0.24	1.04	1.48	2.19	15.33

The table reports summary statistics of the main variables used in the empirical analysis. SYNCH1 is the negative value of the absolute difference in real GDP growth between country i and country j in year t. SYNCH2 is the negative of the absolute difference of residual real GDP growth between country i and country j in year t. SYNCH3 denotes the correlation of the cyclical component of real GDP between country i and j estimated with the Baxter and King Band-Pass filter (2,8). BANKINTI1 denotes the average of bilateral stocks of assets and liabilities of countries i and j normalized by the sum of the two countries' population in year t. BANKINT2 denotes the average of the logs of bilateral stocks of assets and liabilities normalized by the sum of the two countries' GDP. HARMON is a bilateral index of legislative-regulative harmonization policies in financial services in the context of the Financial Services Action Plan (FSAP), initiated by the EU Commission in 1998 to integrate financial services in Europe. The value for each country-pair ranges from 0 to 27, with higher values suggesting a higher degree of harmonization. ERCSUM denotes the sum of the values of the Reinhart and Rogoff (2004) coarse exchange rate classification of countries i and j in the beginning of each year t. For each country the Reinhart and Rogoff (coarse) grid ranges from 1 to 5 with higher values indicating a more flexible currency arrangement.TRADE denotes real bilateral imports and exports as a share of the two countries' GDP (data come from IMF's Direction of Trade Database). SPEC is an index of specialization that reflects the dis-similarities in industrial production in manufacturing between the two countries in each year (data come UNIDO). For details on the construction of all variables see Section 3 and the Data Appendix.

Table 2: Banking Integration and Business Cycle Synchronization

	Annual Data				5-year data			
Integration:	*BANKINT1*		*BANKINT2*		*BANKINT1*		*BANKINT2*	
Synchronization:	*SYNCH1* (1)	*SYNCH2* (2)	*SYNCH1* (3)	*SYNCH2* (4)	*SYNCH3* (5)	*SYNCH3* (6)	*SYNCH3* (7)	*SYNCH3* (8)
Panel A: Cross-Sectional ("Between") Estimates								
Banking Integration (BANKINT)	0.1272 (0.029) *4.42*	0.1039 (0.0193) *5.38*	0.1327 (0.0289) *4.59*	0.1111 (0.0193) *5.76*	0.0391 (0.011) *3.70*	0.0451 (0.017) *2.68*	0.0429 (0.011) *4.04*	0.0530 (0.017) *3.05*
Trade (TRADE)						4.3568 (2.1797) *2.00*		3.8234 (2.1858) *1.75*
Specialization (SPEC)						-0.0123 (0.0270) *-0.46*		-0.0076 (0.0270) *-0.28*
R^2 (between)	0.114	0.161	0.122	0.180	0.083	0.170	0.098	0.18
Year FE	No	No	No	No	No	No	No	No
Country-pair FE	No	No	No	No	No	No	No	No
Observations	153	153	153	153	153	153	153	153
Panel B: Panel ("Within") Estimates								
Banking Integration (BANKINT)	-0.3852 (0.0622) *-6.19*	-0.0718 (0.0278) *-2.58*	-0.3947 (0.0639) *-6.18*	-0.0752 (0.0283) *-2.65*	-0.0430 (0.027) *-1.62*	-0.0741 (0.026) *-2.81*	-0.0429 (0.027) *-1.59*	-0.0745 (0.027) *-2.76*
Trade (TRADE)						-2.5686 (1.2100) *-2.12*		-2.5885 (1.2158) *-2.13*
Specialization (SPEC)						-0.0089 (0.0204) *-0.44*		-0.0088 (0.0205) *-0.43*
R^2 (within)	0.130	0.147	0.130	0.148	0.232	0.280	0.231	0.28
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country-pair FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	4,229	4,229	4,229	4,229	755	480	755	480
Country-pairs	153	153	153	153	153	153	153	153

Panel A reports cross-sectional (between) coefficients. Panel B reports panel fixed-effect (within) coefficients that include a vector of country-pair fixed-effects and a vector of year/period fixed-effects. Standard errors are adjusted for country-pair level heteroskedasticity and autocorrelation and corresponding t-statistics are reported below the estimates. In specifications (1) and (3) the dependent variable is minus one times the absolute difference in real GDP growth between country i and country j in year t (SYNCH1). In specifications (2) and (4) the dependent variable is minus one times the absolute difference of residual real GDP growth between country i and country j in year t (SYNCH2). These models are based on annual observations that cover the period 1978–2006. In columns (5)-(8) the dependent variable is the correlation of the cyclical component of real p.c. GDP between country i and j in each of the 6 five-year periods that cover the period 1978–2006 (SYNCH3; estimated with the Baxter and King Band-Pass filter (2,8)). BANKINT1 denotes the one period lagged value of the average of the logs of bilateral stocks of assets and liabilities normalized by the sum of the two countries' population in year t. BANKINT2 denotes the one year lagged value of the average of the logs of bilateral stocks of assets and liabilities normalized by the sum of the two countries' GDP in year t. TRADE denotes the log of real bilateral imports and exports as a share of the two countries' GDP. SPEC is an index of specialization that reflects the dis-similarities in industrial production (in manufacturing) between the two countries in each period. In columns (5)-(8) we use the values of BANKINT1, BANKINT2, TRADE and SPEC in the end of the previous (five-year) period. The Data Appendix and Section 3 gives details on the construction and the sources of all variables. The Table also gives the number of country-pairs, the number of observations, the between R-squared (for the cross-sectional models) and the within R-squared (for the panel fixed-effect specifications).

Table 3: Legislative Harmonization in Financial Services and Business Cycle Synchronization

	1978–2006					1995–2006				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Financial Sector Harmonization (HARMON)	-0.2420 (0.0430) *-5.62*	-0.2262 (0.0432) *-5.24*	-0.2249 (0.0509) *-4.42*	-0.1219 (0.0577) *-2.11*	-0.1309 (0.0778) *-1.68*	-0.1518 (0.0796) *-1.91*	-0.1776 (0.0762) *-2.33*	-0.2008 (0.0653) *-3.07*	-0.1992 (0.0608) *-3.28*	-0.1666 (0.0647) -2.57
R^2	0.096	0.097	0.117	0.123	0.189	0.15	0.153	0.225	0.227	0.348
Control Variables										
Exchange Rate Regime	No	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes
GDP	No	No	Yes	Yes	Yes	No	No	Yes	Yes	Yes
EU and EURO Controls	No	No	No	Yes	Yes	No	No	No	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country-pair FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country-Specific Trends	No	No	No	No	Yes	No	No	No	No	Yes
Observations	4,229	4,229	4,229	4,229	4,229	1831	1831	1831	1831	1831
Country-pairs	153	153	153	153	153	153	153	153	153	153

The Table reports panel fixed-effect reduced form coefficients. Standard errors are adjusted for country-pair level heteroskedasticity and autocorrelation and corresponding t-statistics are reported below the estimates. The dependent variable is minus one times the absolute difference in real GDP growth between country i and country j in year t (SYNCH1). HARMON is a bilateral time-varying measure of legislative-regulatory harmonization policies in financial services, conducted in the context of the Financial Services Action Plan (that covers capital markets, banking, and insurance). The specifications in columns (1)-(5) are estimated in the full sample of years (1978–2006). The specifications in columns (6)-(10) are estimated over the period 1995–2006. Columns (2)-(5) and (7)-(10) include as control variable a bilateral time-varying measure of the flexibility of the exchange rate regime in the previous year, based on the "coarse" regime classification of Reinhart and Rogoff (2004). The specifications in columns (3)-(5) and (8)-(10) also include the log of the product of the two countries' GDP in the previous year. Columns (4), (5), (9), and (10) also include indicator variables that equal one when one of the two countries is a member of the EU or the euro area in the previous year and indicator variables that equal one when both countries are part of the EU and the euro area in the previous year. Columns (5) and (10) include linear country specific trends. The Data Appendix and Section 3 gives details on the construction and the sources of all variables.

Table 4: Legislative Harmonization, Banking Integration and Business Cycle Synchronization

	Full Sample Period				1995–2006			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Panel A: 2SLS Estimates Dependent Variable: SYNCH1							
Banking Integration (BANKINT1)	-0.5982	-0.5989	-0.6840	-0.4942	-0.7845	-0.9926	-1.5388	-1.8723
	(0.1458)	(0.1439)	(0.1813)	(0.2512)	(0.5010)	(0.4429)	(0.6401)	(0.8656)
	-4.10	*-4.16*	*-3.77*	*-1.97*	*-1.57*	*-2.24*	*-2.40*	*-2.16*
Exchange Rate Regime (ERCSUM)			-0.1146	-0.1387			-0.6054	-0.7177
			(0.0930)	(0.0937)			(0.2346)	(0.2990)
			-1.23	*-1.48*			*-2.58*	*-2.40*
	Panel B: 1st Stage Estimates Dependent Variable: BANKINT1							
Financial Sector Harmonization (HARMON)	*0.4046*	0.3998	0.3288	0.2466	0.1935	0.1768	0.1305	0.1064
	(0.0834)	(0.0598)	(0.0546)	(0.0504)	(0.0473)	0.0386	0.0355	(0.0361)
	4.85	*6.69*	*6.03*	*4.89*	*4.09*	*4.58*	*3.67*	*2.95*
Exchange Rate Regime (ERCSUM)			-0.2392	-0.2071			-0.2905	-0.2912
			(0.0669)	(0.0623)			(0.0612)	(0.0618)
			-3.57	*-3.33*			*-4.74*	*-4.71*
First Stage F-score	23.52	44.71	36.32	23.94	16.71	20.99	13.50	8.67
p-value	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*
GDP Control	No	Yes	Yes	Yes	No	Yes	Yes	Yes
EU and EURO Controls	No	No	Yes	Yes	No	No	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country-pair FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	4229	4229	4229	4229	1831	1831	1831	1831
Country-pairs	153	153	153	153	153	153	153	153

The Table reports panel fixed-effect instrumental variable coefficients. Panel A reports 2nd-Stage estimates. Panel B reports 1st-stage estimates and regression diagnostics . All models include a vector of country-pair fixed-effects and a vector of year fixed-effects. Standard errors are adjusted for country-pair level heteroskedasticity and autocorrelation and corresponding t-statistics are reported below the estimates. In all IV specifications the dependent variable is minus one times the absolute difference in real GDP growth between country i and country j in year t (SYNCH1). The endogenous variable is the one year lagged value of the average of the logs of bilateral stocks of assets and liabilities normalized by the sum of the two countries' population in year t (BANKINT1). It is instrumented with a bilateral time-varying measure of legislative-regulatory harmonization policies in financial services, conducted in the context of the Financial Services Action Plan (HARMON). The specifications in columns (1)-(4) are estimated in the full sample of years (1978–2006). The specifications in columns (5)-(6) are estimated over the period 1995–2006. Column (2)-(4), (6)-(8) include the log of the product of the two countries' GDP in the previous year. Columns (3), (4), (7), and (8) include a bilateral time-varying measure of the flexibility of the exchange rate regime in the previous year, based on the "coarse" regime classification of Reinhart and Rogoff (2004). The specifications in columns (4) and (8) also include as controls two indicator variables that equal one when one of the two countries is a member of the EU or the euro area respectively; and two indicator variables that equal one when both countries are part of the EU and the euro area in the previous year. The Data Appendix and Section 3 gives details on the construction and the sources of all variables.

Appendix Table 1: Cross-Sectional and Panel Estimates

	SYNCH1		*SYNCH2*	
	BANKINT1	*BANKINT2*	*BANKINT1*	*BANKINT2*
	(1)	(2)	(3)	(4)
Panel A: Cross-Sectional Estimates				
Banking Integration	0.0597	0.0849	0.0645	0.0910
(BANKINT)	(0.0224)	(0.0185)	(0.0230)	(0.0189)
	2.67	*4.58*	*2.8*	*4.82*
Year FE	Yes	Yes	Yes	Yes
Country-pair FE	No	No	No	No
Country-Specific Trends	No	No	No	No
R-squared	0.081	0.143	0.082	0.144
Panel B: Panel Estimates I				
Banking Integration	-0.1862	-0.1970	-0.1871	-0.1926
(BANKINT)	(0.0506)	(0.0404)	(0.0513)	(0.0401)
	-3.68	*-4.88*	*-3.65*	*-4.80*
Year FE	No	No	No	No
Country-pair FE	Yes	Yes	Yes	Yes
Country-Specific Trends	Yes	Yes	Yes	Yes
R-squared	0.11	0.09	0.11	0.09
Panel C: Panel Estimates II				
Banking Integration	-0.0940	-0.0995	-0.0989	-0.0995
(BANKINT)	(0.0510)	(0.0386)	(0.0519)	(0.0391)
	-1.84	*-2.58*	*-1.91*	*-2.54*
Year FE	Yes	Yes	Yes	Yes
Country-pair FE	Yes	Yes	Yes	Yes
Country-Specific Trends	Yes	Yes	Yes	Yes
R-squared	0.167	0.168	0.169	0.169
Observations	4,229	4,229	4,229	4,229
Country-pairs	153	153	153	153

Panel A reports cross-sectional (between) coefficients with year fixed-effects. Panel B reports panel fixed-effect (within) coefficients that include also country-specific linear time trends. Panel B reports panel fixed-effect (within) coefficients that include a vector of country-pair fixed-effects, a vector of year fixed-effects, and country-specific linear time trends. Panel C reports specifications with full set of fixed effects. In all specifications, standard errors are adjusted for country-pair level heteroskedasticity and autocorrelation. In specifications (1) and (3) the dependent variable is minus one times the absolute difference in real GDP growth between country i and country j in year t (SYNCH1). In specifications (2) and (4) the dependent variable is minus one times the absolute difference of residual real GDP growth between country i and country j in year t (SYNCH2). These models are based on annual observations that cover the period 1978–2006. BANKINT1 denotes the one period lagged value of the average of the logs of bilateral stocks of assets and liabilities normalized by the sum of the two countries' population in year t. BANKINT2 denotes the one year lagged value of the average of the logs of bilateral stocks of assets and liabilities normalized by the sum of the two countries' GDP in year t. The Data Appendix and Section 3 gives details on the construction and the sources of all variables.

Appendix Table 2: Long-Run

	Dependent Variable: SYNCH3			
	BANKINT1		*BANKINT2*	
	(1)	(2)	(3)	(4)
Panel A: Cross-Sectional Estimates				
Banking Integration	0.0359	0.0246	0.0398	0.0297
(BANKINT)	(0.009)	(0.0097)	(0.0085)	(0.0096)
	4.12	*2.52*	*4.66*	*3.09*
Trade		2.6738		2.3686
(TRADE)		(1.0996)		(1.0916)
		2.43		*2.17*
R-squared (between)	0.109	0.145	0.135	0.164
Panel B: Panel Estimates				
Banking Integration	-0.0967	-0.0968	-0.0908	-0.0910
(BANKINT)	(0.0331)	(0.0332)	(0.0338)	(0.0339)
	-2.92	*-2.91*	*-2.68*	*-2.68*
Trade		-0.7101		-0.8382
(TRADE)		(4.4868)		(4.4800)
		-0.16		*-0.19*
R-2 (within)	0.413	0.413	0.405	0.405
Observations	282	282	282	282
Country-pairs	141	141	141	141

Panel A reports cross-sectional (between) coefficients. Panel B reports panel fixed-effect (within) coefficients that include a vector of country-pair fixed-effects and a vector of period fixed-effects and a period constant. In all specifications the dependent variable is the correlation of the cyclical component of real between country i and j, estimated over a 14-year period (SYNCH3; estimated with the Baxter and King Band-Pass filter (2,8)). BANKINT1 is the average of the logs of bilateral stocks of assets and liabilities normalized by the sum of the two countries' population in year t. BANKINT2 is the average of the logs of bilateral stocks of assets and liabilities normalized by the sum of the two countries' GDP in year t. TRADE denotes the log of real bilateral imports and exports as a share of the two countries' GDP. In all columns we use the values of BANKINT1, BANKINT2, and TRADE in the beginning of each of the two periods. The Data Appendix and Section 3 gives details on the construction and the sources of all variables.

Appendix Table 3: Sensitivity Analysis

	Unilateral Transposition		*Stock Market Turnover*		*Stock Market Capitalization*	
	(1)	(2)	(3)	(4)	(5)	(6)
Financial Sector Harmonization (HARMON)	-0.2994 (0.0939) *-3.19*	-0.2177 (0.1041) *-2.09*	-0.2772 (0.0604) *-4.59*	-0.1906 (0.0619) *-3.08*	-0.3025 (0.0574) *-5.27*	-0.1685 (0.0597) *-2.82*
FSAP in Country i	0.1520 (0.0935) 1.63	0.0356 (0.0928) 0.38				
FSAP in Country j	0.1772 (0.0920) *1.93*	-0.0093 (0.0938) *-0.10*				
Stock Market Turnover in Country i			-0.0004 (0.0011) -0.33	-0.0006 (0.0013) -0.44		
Stock Market Turnover in Country j			0.0002 (0.0008) *0.29*	-0.0024 (0.0009) *-2.60*		
Stock Market Capitalization in Country i					0.0034 (0.0011) 3.23	0.0027 (0.0012) 2.17
Stock Market Capitalization in Country j					0.0036 (0.0012) *3.08*	0.0023 (0.0013) *1.80*
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Country-pair FE	Yes	Yes	Yes	Yes	Yes	Yes
Country-specific trends	Yes	No	Yes	No	Yes	No
Controls	No	Yes	No	Yes	No	Yes
R-squared (within)	0.185	0.227	0.313	0.231	0.305	0.213
Observations	4229	1831	2593	1831	2624	1814
Country-pairs	153	153	153	153	153	153

The Table reports panel fixed-effect coefficients. All models include a vector of country-pair fixed-effects, a vector of year fixed-effects and country-specific linear time trends. The specifications in even numbered-columns also include a vector of country-specific linear time trends. Standard errors are adjusted for country-pair level heteroskedasticity and autocorrelation and corresponding t-statistics are reported below the estimates. In all specifications the dependent variable is minus one times the absolute difference in real GDP growth between country i and country j in year t (SYNCH1). HARMON is a bilateral time-varying measure of legislative-regulatory harmonization policies in financial services, conducted in the context of the Financial Services Action Plan (that covers capital markets, banking, and insurance). The specifications in columns (1), (3), and (5) are estimated in the full sample of years (1978–2006). The specifications in columns (2), (4), and (6) are estimated over the period 1995–2006. Columns (2), (4), and (6) include as control variables: (i) a bilateral time-varying measure of the flexibility of the exchange rate regime in the previous year, based on the "coarse" regime classification of Reinhart and Rogoff (2004); (ii) the log of the product of the two countries' GDP in the previous year; (iii) two indicator variables that equal one when one of the two countries is a member of the EU or the euro area respectively; (iv) two indicator variables that equal one when both countries are part of the EU and the euro area in the previous year. In columns (1) and (2) we include in the set of explanatory variables a country-time-varying index that reflects the degree of legislative harmonization policies in countries i and j in the previous year. In columns (3) and (4) we include stock market turnover in countries i and j in the previous year. In columns (5) and (6) we include stock market capitalization in countries i and j in the previous year.

Figure 1: GDP Synchronization across Time

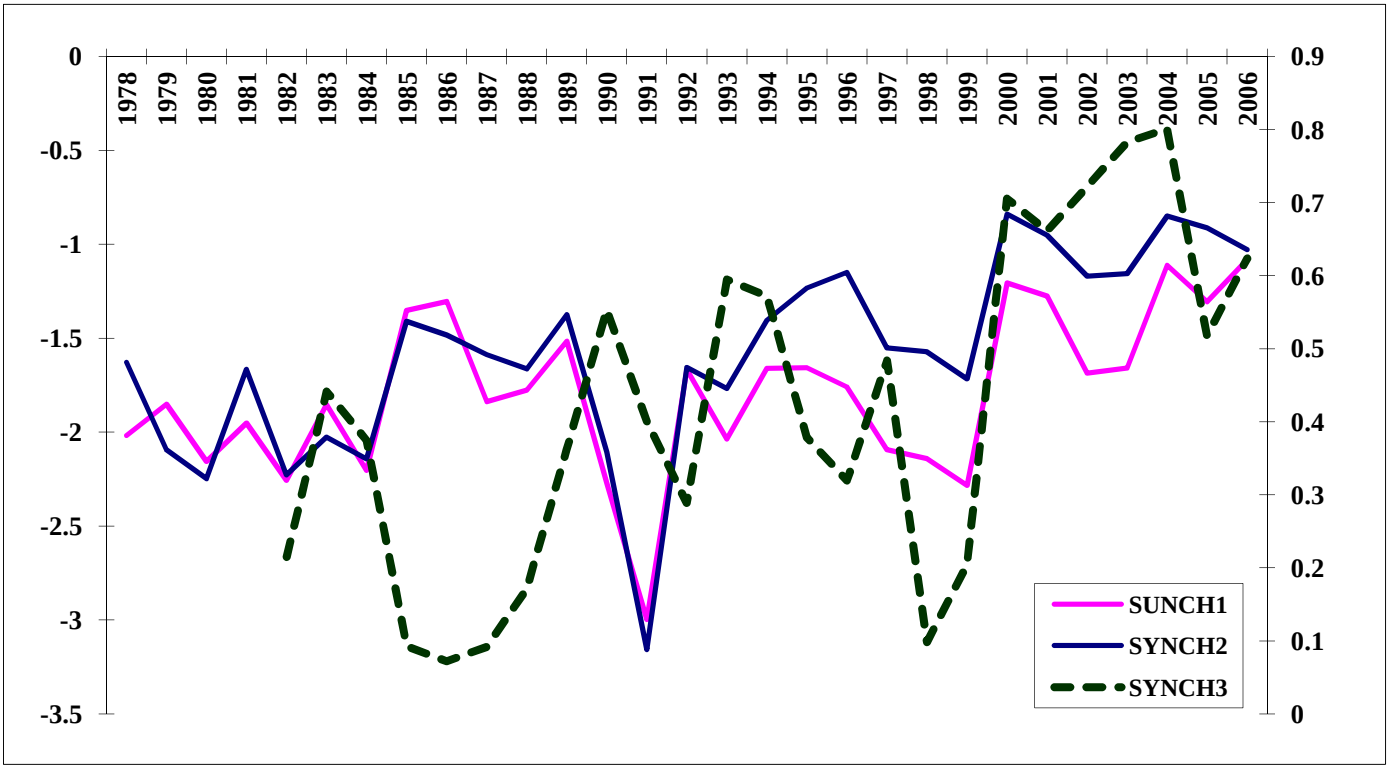


Figure 1 plots the evolution of the average value of each of the three synchronization measures employed in the empirical analysis across the 1978-2006 period. For each year the average is estimated across 153 country pairs (our sample spans 18 countries). *SYNCH1* is the negative value of the absolute difference in real GDP growth between country i and country j in year t. *SYNCH2* is the negative of the absolute difference of residual real GDP growth between country i and country j in year t. *SYNCH3* is the correlation of the cyclical component of real GDP between country i and j in each five-year period (estimated with the Baxter and King Band-Pass filter (2,8)). The correlation is estimated with a five-year rolling window.

Figure 2: Banking Integration over Time

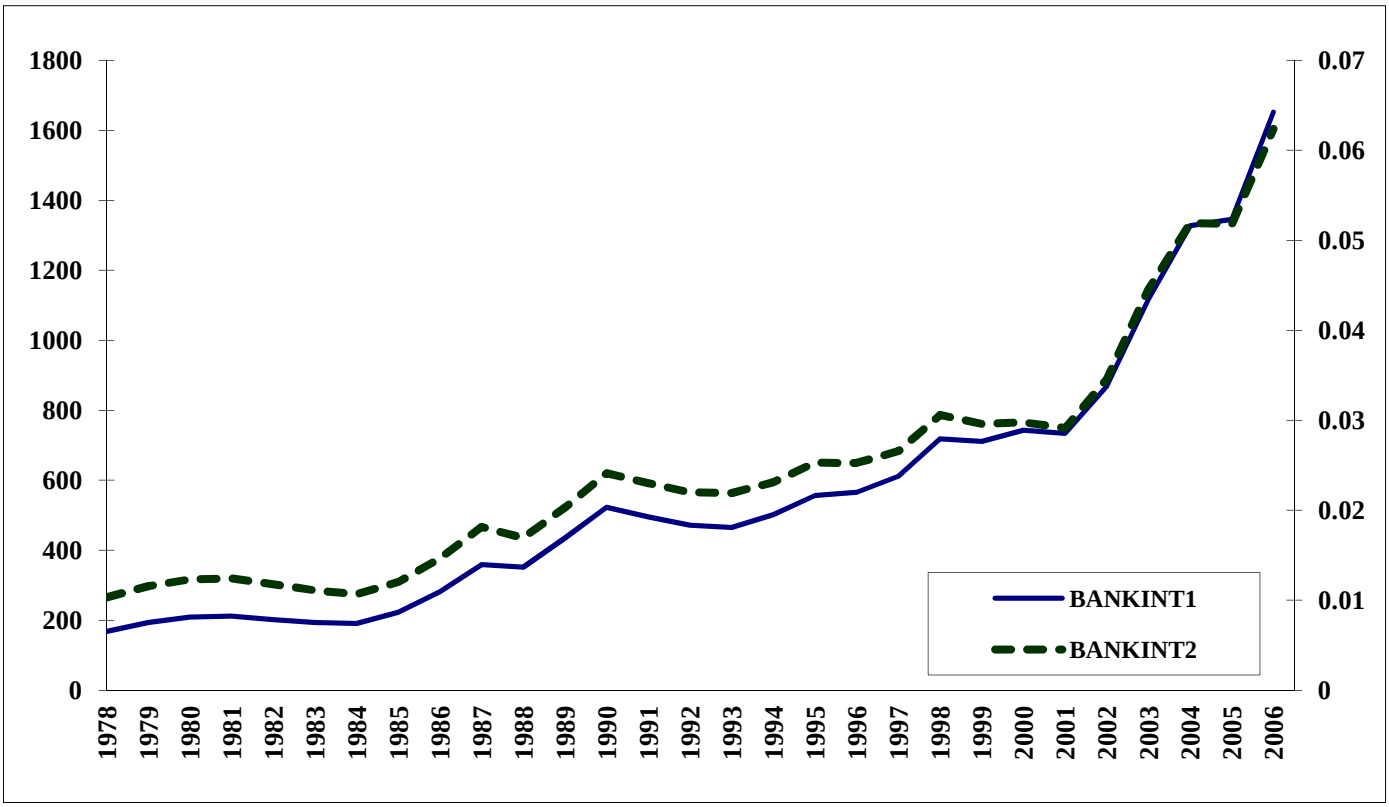


Figure 2 plots the evolution of the two banking integration measures, expressed in levels (solid lines) and in logs (dashed lines). *BANKINT1* denotes the average of the logs of bilateral stocks of assets and liabilities normalized by the sum of the two countries' population. BANKINT2 denotes the average of the logs of bilateral stocks of assets and liabilities normalized by the sum of the two countries' GDP.

Figure 3:
Legislative/Regulatory Harmonization in Financial Services and Banking Integration

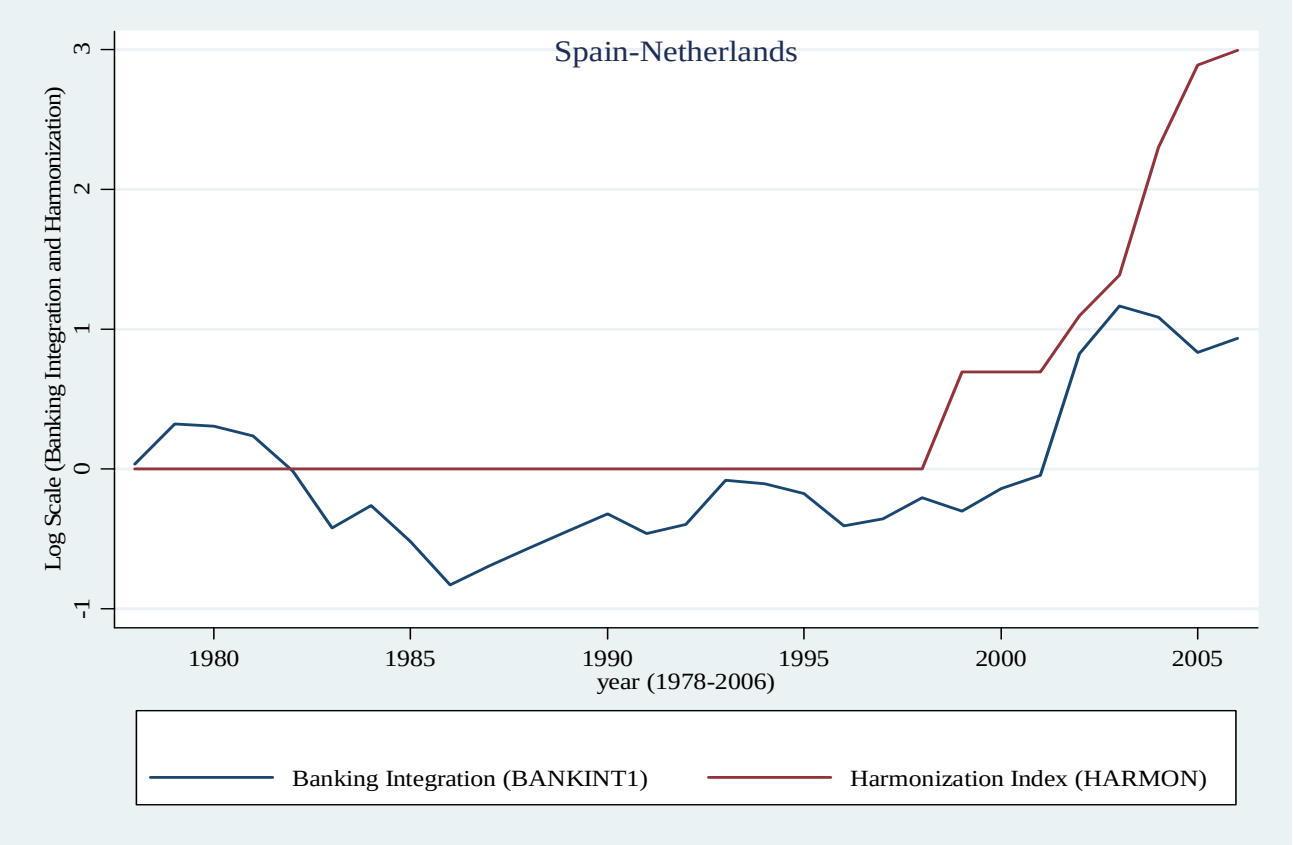
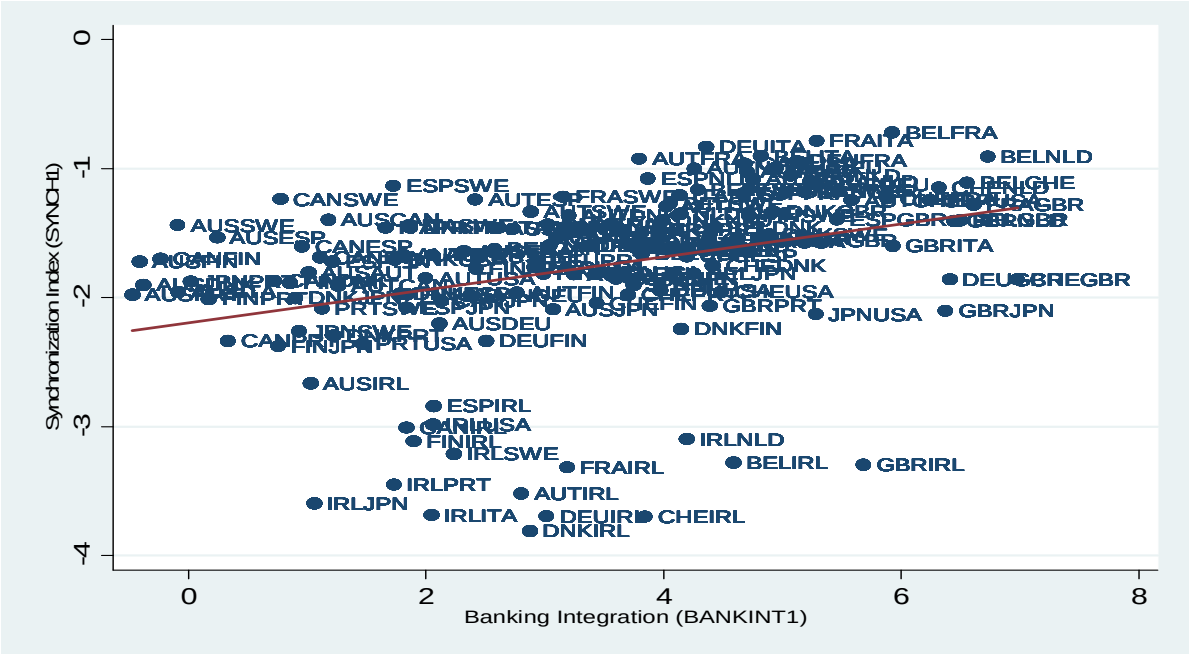
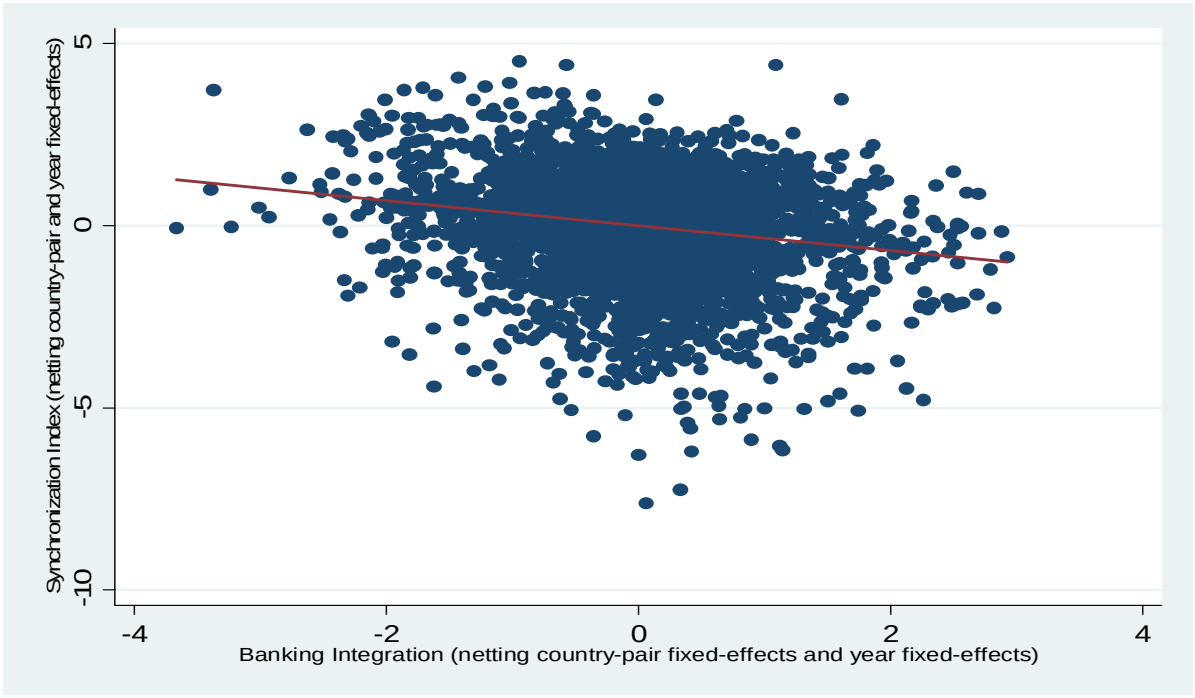


Figure 3 plots the within country-pair and within year evolution over time of banking integration (BANKINT1) and the legislative/regulatory harmonization index in financial services (HARMON) between Spain and Netherlands.

Appendix Figure 1



Appendix Figure 2



Appendix Figure 1 plots the cross-sectional correlation between output synchronization (SYNCH1) in the vertical axis and banking integration (BANKINT1) in the horizontal axis. Each observation corresponds to a country-pair and both output synchronization and banking integration are averages within each country-pair.

Appendix Figure 2 plots the within country-pair and within year correlation between output synchronization (SYNCH1) in the vertical axis and banking integration (BANKINT1) in the horizontal axis. Each observation corresponds to a particular country-pair in each year. To generate the figure we first regress output synchronization and banking integration on country-pair fixed-effects and year fixed-effects. Then we plot the residuals of the synchronization regression in the vertical axis against the residuals from the banking integration regression in the horizontal axis.